

# (12) UK Patent Application (19) GB (11) 2 191 958 (13) A

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**GB 0976768** **GB 0464372**  
**GB 0488666** **US 4461291**

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**B1L**  
**A5T**  
**Selected US specifications from IPC sub-classes B01D**  
**A62B**

## (54) Breathing system

(57) A breathing system includes a filter means comprising a disposable filter cartridge 1 located within a rigid housing so as to filter gas passing through the housing. The filter cartridge 1 comprises a first sheet 4 or 21 of flexible, porous material which contains either an annular recess 5 or a series of recesses or pockets 15, the recess 5 or recesses 15 being filled with a particulate filter material 6 or 16, for example soda lime. A second flat sheet 7 or 22 of porous, flexible material is secured by stitching or other appropriate means to the first sheet 4 or 21 to retain the particulate material 6 or 16 in the recess 5 or recesses 15.

FIG.1.

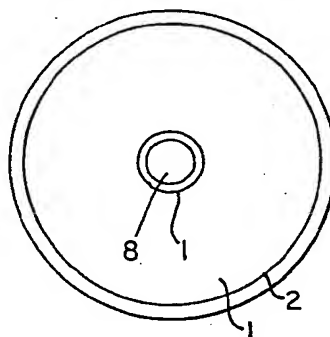


FIG.2.

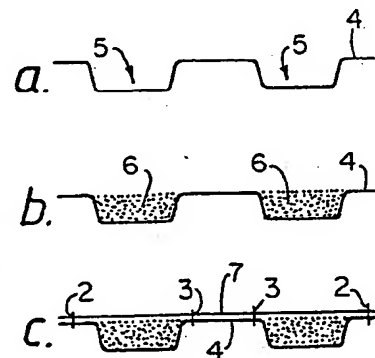
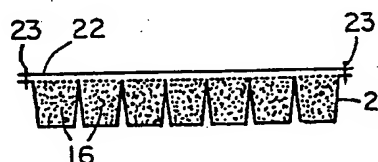


FIG.5.



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FIG. 1.

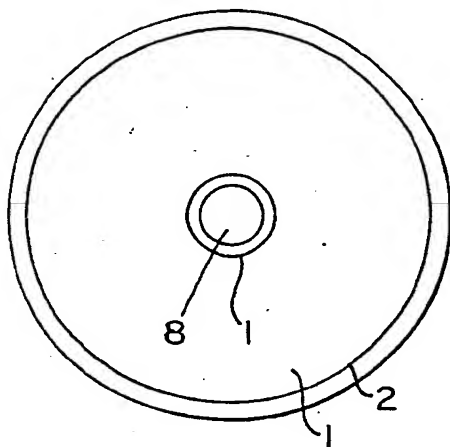


FIG. 2.

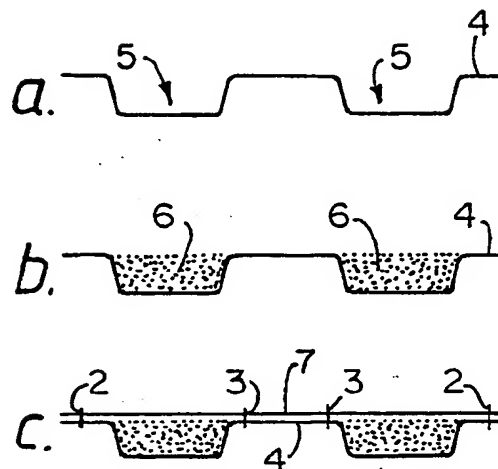


FIG. 4.

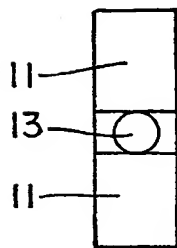


FIG. 3.

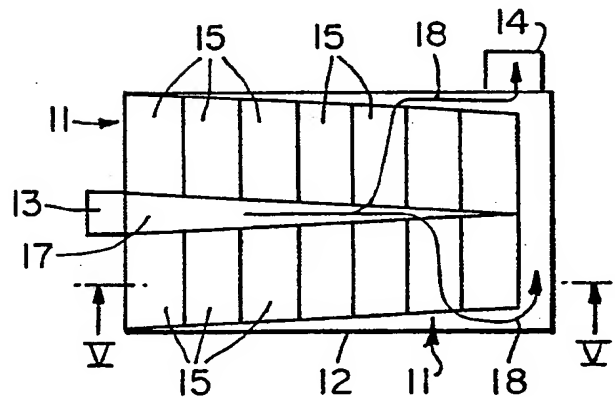
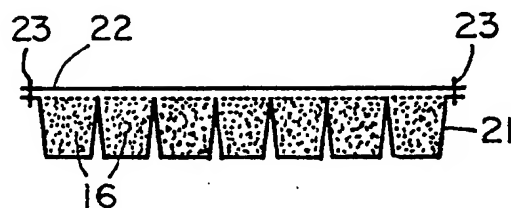


FIG. 5.



## SPECIFICATION

## Breathing system

5 This invention relates to a breathing system and more particularly to a breathing system which includes a filter means.

In accordance with the present invention there is provided a breathing system which includes a filter means comprising a disposable filter cartridge having particulate material held within a container of flexible porous sheet material, and a rigid housing having gas inlet means and gas outlet means, the disposable filter cartridge being located within the rigid housing such that gas entering the gas inlet means passes through the particulate material in the cartridge to reach the gas outlet means.

The particulate material employed in the disposable filter cartridge may be selected for any particular purpose, for example it may be chosen to remove solid matter carried by gas passing into the gas inlet means or it may be designed to react chemically with gases such as toxic gases which it is desired to remove before the gas entering the gas inlet means is breathed by a user of the breathing system. However, in the embodiments of the invention which will be described the particulate material is chosen to be a carbon dioxide absorbent material such as soda lime or lithium hydroxide or a carbon dioxide absorbing and oxygen releasing agent such as potassium superoxide.

In one embodiment of breathing system according to the present invention, the disposable filter cartridge is formed as an annulus surrounding an inhale valve whereby exhaled gases entering the housing through the gas inlet means pass through the disposable filter cartridge to the gas outlet means.

In this embodiment the disposable filter cartridge is made by forming a first sheet of porous material to have an annular recess therein, the annular recess is filled with the particulate material, and a second sheet of porous material is secured to the non-recessed portions of the first sheet material.

45 In another embodiment of breathing system according to the present invention the disposable filter cartridge comprises a series of substantially rectangular pockets in side-by-side relation and each containing particulate material. Advantageously the disposable filter cartridge comprises two series of substantially rectangular pockets in side-by-side relation and each containing particulate material, the said two series being arranged in the rigid housing in a V formation such that gas from the gas inlet means passes into a wedge-shaped recess between the two said series.

In either of these last-mentioned constructions of the disposable filter cartridge, the series of substantially rectangular pockets are formed from a first sheet of porous material, the pockets are filled with particulate material, and a second sheet of porous material is placed over the filled pockets and secured to the first sheet material at the periphery thereof.

65 The flexible porous sheet material may be a

conventional filter paper, a glass fibre filter paper, an open cell plastic foam or any other suitable non-woven textile sheet material, for example a resin impregnated wool.

70 The present invention will be further understood from the following detailed description of preferred embodiments thereof which is made, by way of example, with reference to the accompanying drawings in which:-

75 *Figure 1* is a plan view of a disposable filter cartridge formed as an annulus,

*Figure 2* shows diagrammatically progressive stages in the formation of the disposable filter cartridge of *Figure 1*,

80 *Figure 3* is a diagrammatic plan view of a filter means including another embodiment of a disposable filter cartridge, and

*Figures 4* and *5* are respectively an end view of the filter means of *Figure 3* and a diagrammatic cross-sectional representation of part of a disposable filter cartridge taken along the line V-V of *Figure 3*.

Referring to *Figure 1* there is shown in plan view a disposable filter cartridge 1 in the form of an annulus. The disposable filter cartridge 1 consists of two flexible sheets of porous material, such as conventional filter paper, which are secured together by lines of stitching 2 and 3 so as to form a confined annular space between the two sheets within which a particulate material such as soda lime is retained.

The method of manufacture of the disposable filter cartridge 1 is illustrated in *Figures 2a, b* and *c*, which are diagrammatic cross-sectional views showing three stages in the manufacture. In *Figure 2a* there is shown a first sheet 4 of conventional filter paper which has been pressed so as to provide an annular recess 5 of substantially rectangular cross-section which, in plan view, has the form of an annulus. The recess 5 is then filled with particles 6 of soda lime or other desired filtering material as shown in *Figure 2b*. A second sheet 7 of conventional filter paper is then placed on top of the first sheet 4 and the filled annulus and the two sheets 4 and 7 are secured together by continuous rows of stitching 2 and 3 so that the particulate material 6 is retained within the annulus of substantially rectangular cross-section.

As an alternative to the use of a conventional filter paper the disposable filter cartridge 1 may be formed from a resin impregnated non-woven textile material and the two sheets of such material can be heat sealed at 2 and 3.

In use the disposable filter cartridge 1 is placed in a cylindrical canister of rigid plastics material and an inhale valve is inserted in an aperture 8 formed at the centre of the sheets 4 and 7 within the annulus. The canister will itself be attached to a part of a self-contained breathing system, for example a face mask or hood. After use when the particulate material has been substantially used the filter can be very readily replaced by simply unscrewing the canister, removing the disposable filter cartridge 1 and replacing it by a new similar disposable filter cartridge.

In *Figure 3* of the accompanying drawings there is shown another embodiment of a disposable filter

cartridge 11 which is retained within a substantially rectangular rigid housing 12 having a gas inlet means 13 and a gas outlet means 14. The disposable filter cartridge 11 is formed as a honeycomb or grid framework defining a series of substantially rectangular pockets 15 in side-by-side relation and each containing particles 16 of soda lime as illustrated in the diagrammatic cross-section which is Figure 5. The pockets 15 will have their sides in engagement with one another so that gas entering through the inlet means 13 into a wedge-shaped recess 17 between two similar disposable filter cartridges 11 will be forced to pass through the particulate material in order to reach the gas outlet 14 as indicated by exemplary arrows 18.

The end view of the filter means of Figure 3 is illustrated in Figure 4.

The disposable filter cartridges 11 are formed in essentially similar manner to that already described with reference to Figure 2 above, a lower sheet 21 being pressed into a shape similar to a chocolate box type liner, the particles of soda lime or other filter material being introduced into the pockets 15 so formed and a second sheet 22 being finally placed on top of the assembly and secured around the periphery 23 by suitable means.

This construction of disposable filter cartridge can be used to advantage in the manufacture of a potassium superoxide canister in which carbon dioxide from exhaled breath is absorbed and oxygen generated for recirculation to the wearer of the breathing system which is a closed circuit breathing apparatus.

### 35 CLAIMS

1. A breathing system which includes a filter means comprising a disposable filter cartridge having particulate material held within a container of flexible porous sheet material, and a rigid housing having gas inlet means and gas outlet means, the disposable filter cartridge being located within the rigid housing such that gas entering the gas inlet means passes through the particulate material in the cartridge to reach the gas outlet means.

2. A breathing system according to Claim 1, wherein the particulate material of the disposable filter cartridge is a carbon dioxide absorbent material.

3. A breathing system according to Claim 1, wherein the particulate material of the disposable filter cartridge is a carbon dioxide absorbing and oxygen releasing agent.

4. A breathing system according to any one of Claims 1 to 3, wherein the disposable filter cartridge is formed as an annulus which surrounds an inhale valve within the housing whereby exhaled gases entering the housing through the gas inlet means pass through the disposable filter cartridge to the gas outlet means.

5. A breathing system according to Claim 4, wherein the disposable filter cartridge is made by forming a first sheet of porous material to have an annular recess therein, the annular recess is filled with the particulate material, and a second sheet of

porous material is secured to the non-recessed portions of the first sheet material.

6. A breathing system according to any one of Claims 1 to 3, wherein the disposable filter cartridge comprises a series of substantially rectangular pockets in side-by-side relation and each containing particulate material.

7. A breathing system according to Claim 6, wherein the disposable filter cartridge comprises two series of substantially rectangular pockets in side-by-side relation and each containing particulate material, the said two series being arranged in the rigid housing in a V formation such that gas from the gas inlet means passes into a wedge-shaped recess between the two said series.

8. A breathing system according to either Claim 6 or Claim 7, wherein the series of substantially rectangular pockets are formed from a first sheet of porous material, the pockets are filled with particulate material, and a second sheet of porous material is placed over the filled pockets and secured to the first sheet material at the periphery thereof.

9. A breathing system including a disposable filter cartridge substantially as hereinbefore described with reference to the accompanying drawings.